

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

PASTURE AND HAYLAND PLANTING (ACRE)

CODE 512

MONTANA TECHNICAL GUIDE

SECTION IV

DEFINITION

Establishing native or introduced forage species.

PURPOSES

This practice may be applied as part of a conservation management system to accomplish one or more of the following purposes:

- Establish adapted and compatible species, varieties, or cultivars.
- Improve or maintain livestock nutrition and/or health.
- Extend the length of the grazing season.
- Provide emergency forage production.
- Reduce soil erosion by wind and/or water.
- **Provide food and cover for wildlife.**
- **Reclaim saline seeps.**
- **Improve soil quality/health.**
- **Reduce surface and groundwater degradation.**
- **Provide complementary pastures.**
- **Provide complementary hay.**

CONDITIONS WHERE PRACTICE APPLIES

This practice may be applied on cropland, hayland, pastureland, and other agricultural lands where forage production is feasible and desired.

CRITERIA

General Criteria Applicable To All Purposes Named Above

Plant species and their cultivars shall be selected based upon:

- Climatic conditions, such as annual rainfall, seasonal rainfall patterns, growing season length, humidity levels, temperature extremes, **day length, radiation, heat, wind**, and the USDA Plant Hardiness Zones.
- Soil condition and position attributes such as pH, available water holding capacity **and texture**, aspect, drainage class, inherent fertility, salinity, alkalinity, **and sodicity**, flooding and ponding, and levels of toxic elements that may be present such as selenium and aluminum **and others elements**.
- Plant resistance to diseases and insects common to the site or location.
- Plant compatibility with other forage species and their selected cultivar(s) in rate of establishment, maturity, and growth habit when seeded together as a forage mixture.
- **Desired plant characteristics relative to site and producer's objectives including tolerance to flooding, regrowth ability, root system, relative stand life, drought tolerance, response to irrigation, tendency to produce bloat, forage quality, palatability for livestock and wildlife, tolerance to grazing, and soil protection characteristics.**

NOTE: This type pf font ((**AbBbCcDdEe 123..**)) indicates NRCS National Standards.

This type of font (**AaBbCcDdEe 123..**) indicates Montana Supplement.

Specified seeding/plant material rates, methods of planting and date of planting shall be consistent with documented guidance cited by research institutions or agency demonstration trials for achieving satisfactory establishment.

I. SEEDBED PREPARATION - provide a firm, weed-free seedbed that

- ensures seed will contact soil moisture uniformly (seed to soil contact);
- facilitates seedling emergence;
- provides a medium that does not restrict or allow roots to become dry;
- eliminates seedling competition from weedy species;
- and, seedbed is sufficiently firm when an average sized person sinks 1/8 to 1/4 inch into the soil.

Seedbed Preparation Methods.

NEW SEEDINGS. A suitable seedbed will be prepared using one of the following methods determined to be best suited for the specific planting:

A. Conventional Method.

A firm, weed-free seedbed will be prepared by mechanical tillage. This method is commonly used on cropland for seeding with or without a fallow period. Preparation is normally completed using intensive tillage including moldboard plowing, disking, harrowing, and then packing for sufficient firmness.

B. Reduced-till.

A firm, weed-free seedbed will be prepared by a combination of herbicides* and tillage. This method is typically used on cropland for seeding with a chemical fallow period. Preparation is by season long weed (including volunteer grain) control during the fallow period. The objectives using this method are to germinate and kill as many weed seeds as possible, prevent further seed production, and conserve moisture.

C. No-till.

A firm, weed free seedbed will be prepared without the use of tillage. This method is typically utilized on crop stubble for seeding with a fallow period. Preparation is by season long weed (including volunteer grain) control during the fallow period. Seedbeds must be examined closely for weed seedlings prior to spring or late fall seeding. If excessive weed seedlings are apparent, herbicide application may be necessary to eliminate competition.

D. Preparatory Cover Crop.

A firm, weed free seedbed will be prepared utilizing a cover crop in combination with either conventional or reduced-till methods. This method is typically used on cropland, hayland, or pastureland for seeding with a fallow period. In addition to either the conventional or minimum-till methods, preparation is accomplished by spring seeding an annual crop at a reduced rate to control erosion, trap snow for moisture, and control pests. If excessive amounts of weeds are present, spraying or tillage may be necessary. The cover crop will be terminated by clipping, tillage, or herbicide application prior to heading to prevent seed production. Stubble must be left tall enough to provide erosion protection over winter. The following table identifies crops that are suitable for cover and their corresponding seeding rates.

TABLE 1. COVER CROPS & SEEDING RATES

CROP	SEEDING LBS./AC	SEEDS PER FT ²
Spring wheat	20	6.7
Barley	15	4.5
Oats	20	6.5
Sudangrass	8	10.0
Foxtail millet	8	14.7

For additional information pertaining to cover crops see the Field Office Technical Guide (FOTG), Section IV, Standard 340-Cover and Green Manure Crop.

RE-ESTABLISHMENT SEEDINGS. A suitable seedbed will be prepared using one of the following methods determined to be best suited for the specific planting:

- A. Prepare a seedbed using conventional, reduced till or no-till methods without a fallow period. Plant to an annual crop for at least one year to provide adequate time to kill existing grass/legume, allow decay of sod, and to control weeds. Caution should be exercised using this method in low precipitation areas in consideration of high potential for erosion.
- B. Prepare a seedbed using conventional or minimum-till methods. Summer fallow for one growing season to control weeds and excess vegetation that will compete with the newly stand and store soil moisture.
- C. For immediate re-establishment, prepare a seedbed by first spiking or discing about three inches deep to cut the sod. Two passes are required. The second should be completed across (45° angle to) the first. Then use conventional methods to complete the seedbed preparation as outlined under new seedings.

* Specifications for the kind of chemical and methods and time of application will be accordance with all label instructions. Recommendations must follow those published in the Montana-Utah-Wyoming Weed Management Handbook.

II. FERTILIZER

- A. The application of nitrogen is not usually required for grass/legume establishment. However, if soil test results show that nitrogen levels are low or very low, light rates of available nitrogen may be applied with the seed at planting (up to ten pounds actual N). Nitrogen fertilizer is not needed as long as alfalfa makes up at least 25 percent of an established stand.
- B. Where required, phosphorus, potassium, and sulphur, should be applied. Applications will be based on soil test results and expected production requirements (see FOTG, Section IV, 590-Nutrient Management)

III. SPECIES SELECTION

The selection of species for any grass, legume, or grass/legume seeding will meet the following requirements:

- A. Species will be adapted to the site (soil and climatic factors). Refer to FOTG, Section II, Pasture and Hayland Interpretations-Species Selection Criteria for Seeding Dryland Pastures in Montana and Wyoming, EB 19, Montana State University - Extension Service, Revised February 1991; Species Selection, Seeding Techniques, and Management of Irrigated Pastures in Montana and Wyoming, EB 99, April 1991; the Montana Interagency Plant Materials Handbook, EB 69, Montana State University - Extension Service, reprinted April 1993, or other guides as approved by the state conservationist.
- B. All seed and planting materials shall be labeled and meet state seed quality law standards. Seed will comply with current Federal and Montana State seed quality criteria. See FOTG, Section I, State/Local Laws for the Montana Agricultural Seed Act and Administrative Rules, State of Montana Department of Agriculture.
- C. Use certified seed and recommended cultivars whenever available. Only certified seed adapted to Montana soil and climatic conditions may be used. When certified seed is not available, common seed may be used. Seed should not be used if the origin or cultivar is unknown. Plantings of native species can be made with seed harvested from native stands in Montana or adjacent states and provinces within a geographic range of 300 miles north or 500 miles south of the planting site. The east-west range is determined by similar elevation and precipitation.
- D. Species will be adapted to the intended use. Reference the Montana Interagency Plant Materials Handbook, EB 69, reprinted April 1993, for information regarding pertinent use.

- E. Suitable species are given in TABLE 2 - for irrigated (or precipitation ≥ 18 inches) fields and TABLE 3 - for non-irrigated (or < 18 inches precipitation) fields.
- F. All seed must be tested and tagged in accordance with all Federal and Montana Agricultural Seed Act and Administrative Rules (See FOTG, Section I, State/Local Laws, Ordinances, and Regulations). Each species must have a separate tag identifying the germination and purity so that verification of adequate amounts of PLS can be determined.

IV. SEEDING RATES AND MIXTURES

Seeding rates will be calculated on a pure live seed (PLS) basis.

- A. Use either TABLE 2 or TABLE 3, Seeding Rates of PLS for Grasses and Legumes, to determine pounds of pure live seed (PLS) required for a pure stand.
- B. For planting mixtures of two or more species, determine the total pounds of PLS required by multiplying the full seeding rate of each species by the percentage desired within the total mixture. Use the worksheet in the seeding specification for step by step guidance.

V. SEED TREATMENT

- A. Many species of grasses and cereals are attacked by soil-borne fungi which reduce emergence and vigor. Seed may be treated before planting with an appropriate fungicide if past experience or field history dictates treatment necessary. Fungicide recommendations must adhere to all manufacturer's label directions and precautions for treatment and handling of seed.
- B. Legume seed shall be inoculated with the proper, viable symbiotic rhizobia before planting. Do not use inoculates after the expiration date indicated on the container.

VI. TIME OF SEEDING

- A. Spring seedings will be completed by May 15.
- B. Seedings will be made after May 15 only when there is a minimum of two feet of moist soil. The soil must also be moist to within two inches of the surface. These seedings must be completed by August 15.
- C. Dormant fall seedings can be made after October 15 or when soil temperatures 2 inches below the soil surface remains at 40° F or less for ten or more days.
- D. Species with dormant seed such as green needlegrass and Indian ricegrass must be planted as a dormant fall seeding unless germination by standard seed test is greater than 50 percent. If dormant species are a minor component of a mixture, spring seeding is acceptable.
- E. When irrigation is provided, planting may be completed at any time during the growing season up to 45 days prior to the cutoff date. The cutoff date is October 1.

VII. COMPANION CROPS

- A. Companion Crops. In general, seeding companion crops with perennial grasses or legumes is not recommended as they provide too much competition for seedlings and will typically reduce the subsequent forage yield, particularly when moisture is limiting. However, under eroding conditions, in heavy clay soils prone to crusting, or in higher precipitation areas, they can be successfully used. Decreasing the companion crop seeding rate and seeding the crops at right angles or in alternate rows will reduce competition.
- 1. Irrigated. Companion crops may be used at a full or reduced rate and harvested for forage or grain. Irrigation will be applied to meet the needs of the seeding.

2. Dryland Companion crops are not recommended for establishing dryland pasture or hayland where annual precipitation is less than 16 inches. In areas where annual precipitation is 16 inches or greater, or where erosion is a concern, a spring grain companion crop may be seeded at the following rates:

Spring wheat - 10 lbs/acre (3.3 seeds/ft)

Barley - 10 lbs/acre (3.0 seeds/ft)

Oats - 10 lbs/acre (3.3 seeds/ft)

Companion crops are best removed early as hay or silage leaving a tall stubble (6-8 inches) for snow trapping. However, they may be harvested for grain.

When grass and/or legumes are seeded with the companion, crop seeding depth will not exceed 1 inch.

VIII. SEEDING METHODS

- A. **Planting.** Install plantings with a drill or air seeder calibrated to the correct seeding rate and set for the correct depth of planting. Acceptable planters include, but are not limited to, a single-disk, double-disk or deep furrow drill.

If planting is to be completed by broad-casting the seed (1) seeding rates must be doubled if no other operation will take place after seed broadcasting, (2) recommended seeding rates may be used (from TABLE 2 or TABLE 3) if the seedbed is roughened, seed broadcast, covered with a spike-tooth harrow or like implement, and then rolled with a packer or culti-packer.

- B. **Seeding Depth.** Small grass, forbs, and legume seeds will be planted no deeper than 1/2 inch. Large grass seed will be planted no deeper than 3/4 inch. Drills fitted with depth bands and packer wheels are strongly recommended.
- C. **Row Spacing.** The minimum row spacing for Russian wildrye is 18 inches where little hazard from wind or water erosion exists. Where an erosion hazard does exist, consider two seeding operations, with the second operation perpendicular to the first or alternate rows with alfalfa 18 in. wide. All other species will be planted 14 inches or less row spacing.

- D. Where slopes are greater than 5 percent, planting will be completed on the contour or across the general slope of the land.

IX. MANAGEMENT OF NEW PLANTINGS

- A. New seedlings should not be grazed until the stand has matured beyond the seedling stage. Refer to FOTG, Section IV, 528 - Prescribed Grazing.
- B. New seedlings should not be hayed until the stand is beyond the seedling stage to ensure a vigorous. Refer to FOTG, Section IV, 511 - Forage Harvest Management.
- C. During the establishment period, control competitive weed growth and undesirable vegetation by clipping or application of appropriate herbicides. Refer to FOTG, Section IV, 595 - Pest Management.

Additional criteria for improving or maintaining livestock nutrition and/or health.

Forage species must be capable of meeting the desired level of nutrition for the kind and class of livestock to be fed.

Additional criteria for extending the grazing season.

Forage species selected for establishment shall fulfill a recognized dietary deficiency within the year long forage management program.

Additional criteria for providing emergency forage production.

Select plants that will produce forage for use during periods when other on-farm/ranch forage is unavailable to meet livestock needs.

Additional criteria for reducing erosion by wind and/or water.

Plants shall have the ability to provide adequate ground cover, canopy cover, root mass, and vegetal retardance to wind forces and water flows either alone or in combination with other forage species when site conditions require erosion protection.

Additional criteria for seeding of CRP stands.

Various innovative methods of seeding may be proposed by producers to enable completion of seeding in a timely manner. Some methods may not be listed in this standard, the 550 - Range Planting standard, or the 645 - Wildlife Upland Habitat Management standard. However, this does not mean the alternative methods will not produce acceptable stands of CRP plantings.

The following items must be completed to effectively plant CRP acreage using innovative methods:

1. seed must be distributed evenly over the entire acreage.
2. seed must be covered with a light layer of soil (1/4 to 1/2 inch).
3. soil surface must be firm enough after seeding to provide good seed-to-soil contact for proper germination.
4. weeds must be controlled to eliminate competition.

If an operator wants to use an innovative method of planting, the above four criteria must be met. If these criteria are met and the field office determines that the method is technically sound, the innovative method can be approved. However, if the seeding fails, the producer is responsible for re-seeding until the acreage is certified.

CONSIDERATIONS

Prescribed Burning, Pest Management, Prescribed Grazing, Brush Management, and Grazing Land Mechanical Treatment practices may be used in combination with Pasture and Hayland Planting.

Where wildlife management is an objective, the food and cover value of the planting can be enhanced by using an approved habitat evaluation procedure to aid in selecting plant species and providing for other habitat requirements necessary to achieve the objective.

Forage species planted in the mixture should exhibit similar palatability to one another to avoid spot or selective grazing.

All prepared seedbeds should be firm at the point of seed placement. Most seedbeds for drilled plantings should be packed so that an average size person will leave footprints approximately 3/8 inch deep. When planting with a deep furrow drill, the seedbed will not need to be packed as firmly as with a disk drill; however, the point of seed placement must be firm.

A seedbed preparation method should be selected that best suits the site. The selected seedbed preparation should retain the maximum amount of soil moisture.

Plow/plant techniques are effective for land with excessive weed growth, especially grassy weeds. When using this technique it is essential to have moist soil to a depth of 12 inches. Plowing must be completed to bury weed seed deep enough to retard germination and to cover existing residue. In some cases, raking or burning before plowing may be necessary. Typically, disking, harrowing, and packing should follow plowing in close succession to conserve moisture and permit adequate packing.

Some sites may require only one or two tillage operations to prepare a seedbed. Usually tillage is for the purpose of killing all weeds to eliminate competition. Chemical weed control may be substituted for one or all of the tillage operations when preparing a seedbed. Cultivation is usually done with a tool bar, but other implements such as a disk, rodweeder, harrow, Noble blade, sweeps, etc., may be used as appropriate.

Avoid very shallow seeding in mid-summer. The objective is to place seed in moist soil. It may be desirable to seed at shallower depths in clay soils subject to crusting and in well prepared firm seedbeds where the moisture is near the surface at seeding time.

For chaffy grass seed, especially native species, planting should be done at about 3 mph. The fluffier the seed the slower the drill speed. Rice hulls or other carriers may be required for adequate flow through the drill box.

Fill seed boxes loosely, level to the top. Do not pack seed into the box. Packed seed will not flow through the drill the same, if at all, and calibration will be inaccurate. If possible, use a drill with an agitator in the seed box.

As a good rule of thumb, if the soil is wet enough to stick to the coulters, it is too wet to plant.

Avoid backing up the drill when it is in the down position to eliminate plugging of the drop tube. Minimize making turns so sharp as to cause one end of the drill to back up.

When planting around a field rather than back and fourth, drill with the drive wheels to the inside. Avoid figure eight turns.

When moving from one field to another, re-fluff chaffy seed manually before starting to drill again. Seed settles and packs when drills are moved.

Plantings completed in late fall or early spring provide the greatest probability of success. Certified seed is recommended to assure varietal identity, genetic purity, and freedom of noxious weeds.

In areas where frequent winter thawing of the soil occurs, seeds may germinate during winter and rot when dormant seedlings are made. In these areas plan for spring plantings.

Alternate row plantings may be used to improve establishment where species competition is a problem. Planting two or three rows of one species with one row of another may also be used to reduce competition.

Mixtures of grasses and legumes will generally produce more animal products than a grass or legume alone.

When planting on previously cropped land, the kinds of residual herbicides used in the cropping system the last several years must be considered to prevent planting failures.

High levels of nitrogen fertilizer broadcast before seeding may promote weed growth more than it aids the establishment of grass. Where soil tests indicate low nitrogen levels, additional nitrogen needed to promote high levels of production should be top dressed after stand establishment.

Very light grass seed, such as Garrison creeping foxtail, may require the use of a “carrier” in the drill box to assure uniform flow through the planter.

PLANS AND SPECIFICATIONS

Specifications for the establishment of pasture and hay plantings shall be prepared for each site or management unit according to the Criteria, Considerations, and Operations and Maintenance described in this standard, and shall be recorded on specification sheets, job sheets, in narrative statements in the conservation plan, or other acceptable documentation.

A pasture and hayland planting plan shall include the following information:

1. Location map - field numbers and a map or sketch of the area to be planted.
2. Measured acres.
3. Date practice scheduled and applied.
4. Seedbed preparation used.
5. Seeding method and depth of seeding.
6. Companion crop (if used) and rate.
7. Erosion prediction before and after if primary purpose is for erosion control.
8. Mixture and seeding rate (PLS), including selected cultivars.
9. Seed inoculation or treatment required.
10. Protection provided during establishment period.
11. Other useful comments.
12. Date and signature of producer and NRCS.

The Montana Pasture and Hayland Planting Specification is applicable to this practice and is required.

OPERATION AND MAINTENANCE

Growth of seedlings or springs shall be monitored for water stress. Water stress may require reducing weeds, early harvest of any companion crops, irrigating when possible, or replanting failed stands, depending on drought severity. Invasion by undesirable plants shall be controlled by cutting, using a selective herbicide, or through grazing management by manipulating livestock stocking rates, density, and duration of grazing. Insects and diseases shall be controlled when infestation threatens and stand survival.

REFERENCES

Montana Interagency Plant Materials Handbook., Montana State University Extension Service, EB 69, April 1993.

Soil Improvement with Legumes. Saskatchewan Soil and Crop Management Subcouncil., March 1995.

1997-1998 Montana, Utah, Wyoming, Weed management Handbook. Montana State University and University of Wyoming Extension Service.

Species Selection Criteria for Seeding Dryland Pastures in Montana and Wyoming, Montana State University Extension Service, EB 19, February 1991.

Species Selection, Seeding Techniques and Management of Irrigated Pastures in Montana and Wyoming, Montana State University Extension Service, EB 99, April 1991.

USDA, Natural Resources Conservation Service, Field Office Technical Guide, Section IV, Pest Management (595), December 1991.

USDA, Natural Resources Conservation Service, Field Office Technical Guide, Section IV, Nutrient Management (590), September 1998.

Tips for Drilling Chaffy Grass Seed: Attention to Detail Essential., Land and Water Magazine, July/August 1997.

USDA Plant Hardiness Zone Map., USDA ARS, Miscellaneous Publication No. 1475, January 1990.

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service.

TABLE 2. SEEDING RATES OF PLS FOR GRASSES AND LEGUMES.

Irrigated (or greater than 18" from precipitation, run-in, or overflow).

SPECIES	ORIGIN ^{1/}	SEEDS/LB.	LBS. / AC	
			PLS ^{2/}	CULTIVARS
GRASSES:				
bluegrass, Kentucky	I	2,156,000	3	Troy
bromegrass, meadow	I	93,000	6	Regar, Paddock, Fleet
bromegrass, mountain	N	80,000	10	Bromar
bromegrass, smooth	I	125,000	7	Lincoln, Manchar, Rebound
canarygrass, reed	N	602,000	4	Ioreed, Palaton, Vantage, Frontier
fescue, tall	I	242,000	6	Alta, Kenmont, Fawn
foxtail, creeping	I	720,000	3	Garrison, Retain
foxtail, meadow	I	500,000	4	
needlegrass, green	N	186,000	6	Lodorm
orchardgrass	I	464,000	4	Latar, Chinook, Potomac
ryegrass, perennial	I	247,000	4	Friend, Linn, Dairymaster, Zero Nui
sacaton, alkali	N	1,750,000	3	
timothy	I	1,300,000	4	Climax, Drummond, Hopkins
wheatgrass, intermediate	I	79,000	7	Oahe, Amur, Greenar, Reliant, Rush
wheatgrass, pubescent	I	80,000	7	Luna, Manska, Greenleaf
wheatgrass, tall	I	79,000	10	Jose, Alkar, Largo
wheatgrass, western	N	93,000	6	Rosana, Barton, Rodan, Arriba
wildrye, beardless	N	181,000	6	Shoshone
wildrye, Altai ^{3/}	I	80,000	12	Prairieland, Pearl, Eejay
LEGUMES:				
alfalfa	I	225,000	6	(SEE EXT. BULLETIN EB 99)
clover, alsike	I	700,000	4	
clover, ladino	I	800,000	3	
clover, red	I	272,160	6	
clover, strawberry	I	300,000	5	
clover, white	I	800,000	3	
milkvetch, cicer	I	134,000	8	Lutana, Monarch, Windsor
Sainfoin	I	18,500	45	Remont
sweetclover, white	I	262,000	6	
sweetclover, yellow	I	258,000	6	
trefoil, birdsfoot	I	418,000	5	Empire, Leo, Dawn

^{1/} I = Introduced N = Native.

^{2/} Seeding rates are calculated for 12" or less row spacing. For row spacing wider than 12 inches, calculate seeding rate as follows: [lbs. PLS/Ac. from chart] X [12" divided by actual row spacing if more than 12"] = actual lbs. PLS/Ac.

^{3/} Particularly high water table and/or saline situations.

SEEDS PER LINEAR FOOT CALCULATIONS: (FOR CALIBRATION AND CHECKING DRILL)

$$\frac{\text{Seeds / lb.}}{43,560} \times \text{Bulk Seeding Rate} \times \frac{\text{Row Spacing (in.)}}{12 \text{ inches}} = \text{Seeds / Linear Foot in Row}$$

TABLE 3. SEEDING RATES OF PLS FOR GRASSES AND LEGUMES.

Non-irrigated (or less than 18" from precipitation).

SPECIES	ORIGIN ^{1/}	SEEDS/LB.	LBS. / AC	
			PLS ^{2/}	CULTIVARS
GRASSES:				
bluegrass, Big ^{3/}	N	882,000	1-2	Sherman
bluegrass, Sandbergís ^{3/}	N	900,000	1-2	
bluestem, big	N	130,000	5	Bison, Bonilla, Sunnyview
bluestem, little	N	260,000	4	Blaze, Badlands, Camper
bluestem, sand	N	113,000	6	Garden, Goldstrike
bromegrass, meadow ^{4/}	I	93,000	7	Regar, Paddock, Fleet
bromegrass, mountain	N	80,000	10	Bromar
bromegrass, smooth	I	125,000	5	Lincoln, Manchar, Rebound
fescue, hard	I	565,000	3	Durar
fescue, Idaho	N	450,000	3	Nez Purs, Joseph
fescue, sheep	N	680,000	3	Covar
fescue, rough	N	200,000	5	
grama, blue	N	800,000	3	Alma, Bad River
grama, sideoats	N	191,000	3	Butte, Killdeer, Pierre
junegrass, prairie ^{3/}	N	2,315,000	1-2	
needle-and-thread	N	115,000	7	
needlegrass, green	N	186,000	6	Lodorm
orchardgrass	I	464,000	3	Paiute
ricegrass, Indian	N	235,000	6	Nezpar, Rimrock, Paloma
sacaton, alkali	N	1,750,000	2	
sandreed, prairie	N	273,700	4	Goshen
switchgrass	N	390,000	4	Dacotah, Forestburg, Sunburst
timothy	I	1,300,000	3	Climax, Drummond
wheatgrass, beardless	N	109,000	6	Whitmar
wheatgrass, bluebunch	N	139,000	7	Secar, Goldar
wheatgrass, fairway crest.	I	200,000	4	Fairway, Summit
wheatgrass, standard crest.	I	188,000	5	Nordan, Douglas
wheatgrass, stand. X fair.	I	175,000	5	Hycrest, CD II
wheatgrass, intermediate	I	79,000	7	Oahe, Amur, Greenar, Reliant, Rush
wheatgrass, hybrid	I	134,000	8	Newhy
wheatgrass, pubescent	I	80,000	7	Mandan 759, Luna, Greenleaf, Manska
wheatgrass, siberian	I	163,000	6	P-27, Vavilov
wheatgrass, slender	N	140,000	6	Pryor, Revenue, San Luis
wheatgrass, streambank	N	152,000	5	Sodar
wheatgrass, tall	I	79,000	10	Jose, Alkar, Largo
wheatgrass, thickspike	N	145,000	5	Critana, Bannock
wheatgrass, western	N	93,000	6	Rosana, Rodan
wildrye, Altai	I	80,000	12	Prairieland, Pearl, Eejay
wildrye, basin	N	125,000	6	Magnar, Tralhead
wildrye, beardless	I	181,000	6	Shoshone
wildrye, Dahurian	I	80,000	11	James, Arthor
wildrye, Russian ^{2/}	I	170,000	6	Swift, Mankota
wildrye, Russian ^{2/}	I	134,000	6	Bozoisky Select
FORBS:				
burnett, small (forb)	I	42,243	20	Delar
flax, Lewis	N	286,690	5	Appar
sunflower, Maximillian ^{3/}	N	226,512	1	Prairie Gold

TABLE 3. SEEDING RATES OF PLS FOR GRASSES AND LEGUMES CONTINUED.

Non-irrigated (or less than 18" from precipitation).

SPECIES	ORIGIN ^{1/}	SEEDS/LB.	LBS. / AC PLS ^{2/}	CULTIVARS
LEGUMES:				
alfalfa	I	225,000	5	(see Ext. Bulletin EB 99)
clover, purple prairie	N	275,000	3	Kaneb
clover, strawberry	I	300,000	3	
milkvetch, cicer	I	14,000	7	Lutana, Monarch, Windsor
sainfoin	I	18,500	34	Eski, Melrose
sweetclover, white	I	262,000	4	
sweetclover, yellow	I	258,000	4	
SHRUBS:				
saltbush, four-wing	N	49,000/24,500	5/10	Wytana (dewinged/winged)burnett,
winterfat (shrub)	N	111,000	8	

^{1/} I = Introduced N = Native.

^{2/} Seeding rates are calculated for 12" or less row spacing. For row spacing wider than 12 inches, calculate seeding rate as follows: [lbs. PLS/Ac. from chart] X [12" divided by actual row spacing if more than 12"] = actual lbs. PLS/Ac.

^{3/} Need carrier to achieve this low seeding rate.

^{4/} Minimum 15 inches mean annual precipitation.

SEEDS PER LINEAR FOOT CALCULATIONS: (FOR CALIBRATION AND CHECKING DRILL)

$$\frac{\text{Seeds / lb.}}{43,560} \times \text{Bulk Seeding Rate} \times \frac{\text{Row Spacing (in.)}}{12 \text{ inches}} = \text{Seeds / Linear Foot in Row}$$